TITLE: METHODS AND APPARATUS FOR SWITCHING FIBRE CHANNEL ARBITRATED LOOP SYSTEMS
INVENTOR(S): Warren
U.S. Serial No.: Not yet assig Not yet assigned 1 of 52

Page: Exp Mail label EV337190990US

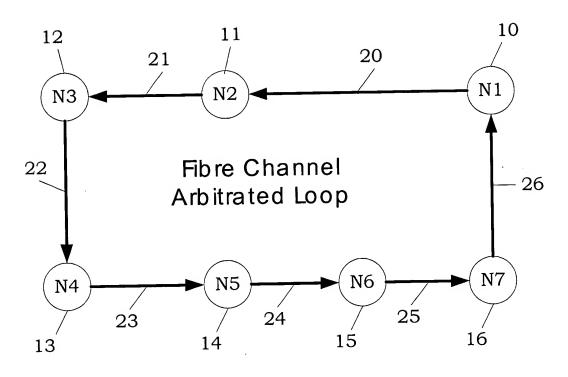


Fig. 1

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Not yet assigned

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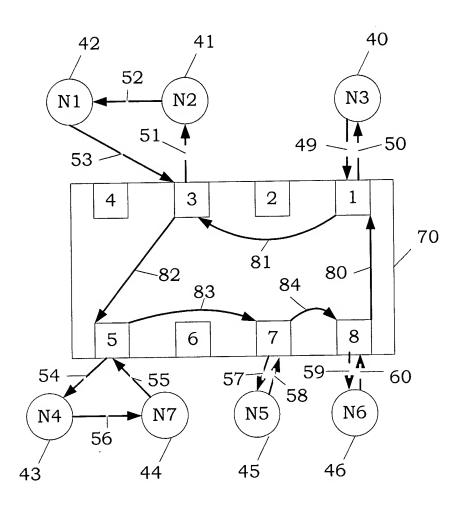


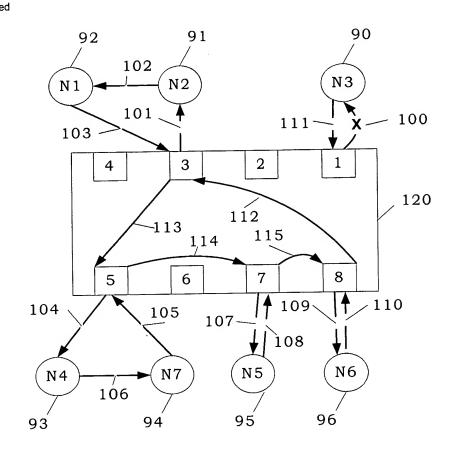
Fig. 2

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Fibre Channel Arbitrated Loop Hub

Fig. 3

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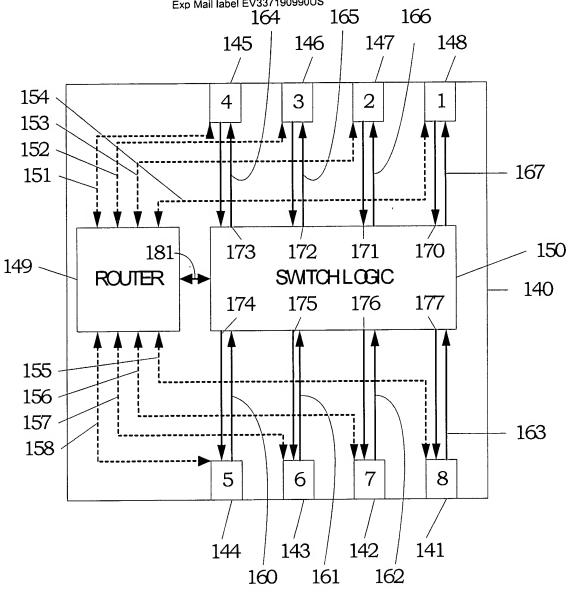


Fig. 4

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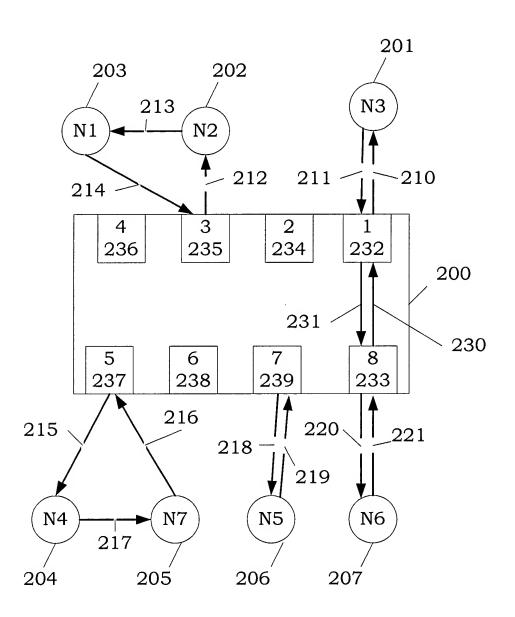


Fig. 5

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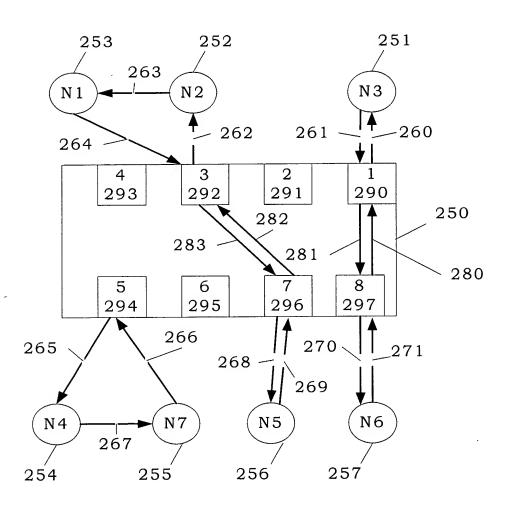


Fig. 6

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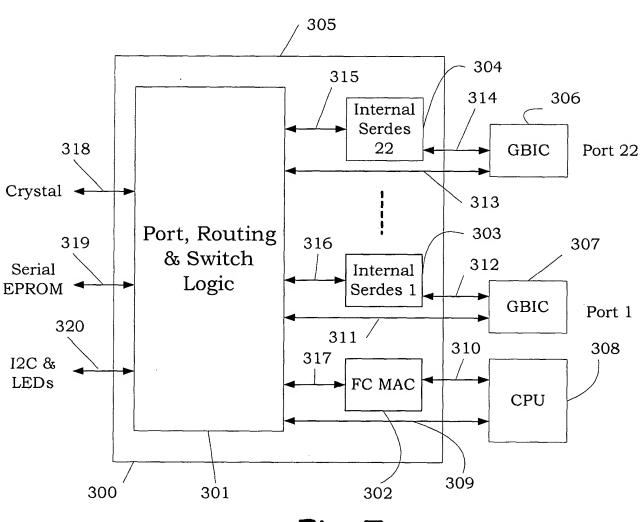


Fig. 7

U.S. Serial No.: Not yet assigned Page: 8 of 52 Exp Mail label EV337190990US

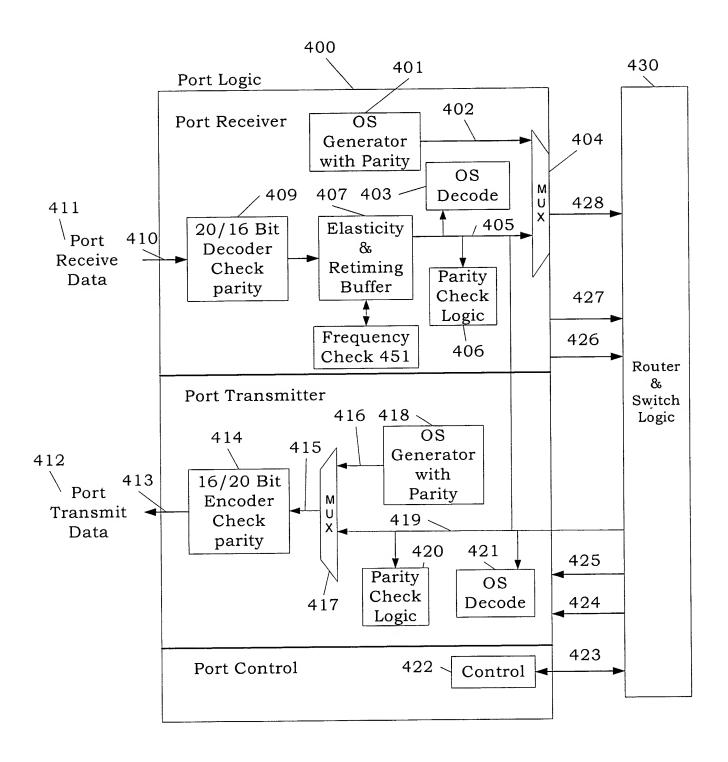


Fig. 8

TITLE: METHODS AND APPARATUS FOR SWITCHING FIBRE CHANNEL ARBITRATED LOOP SYSTEMS

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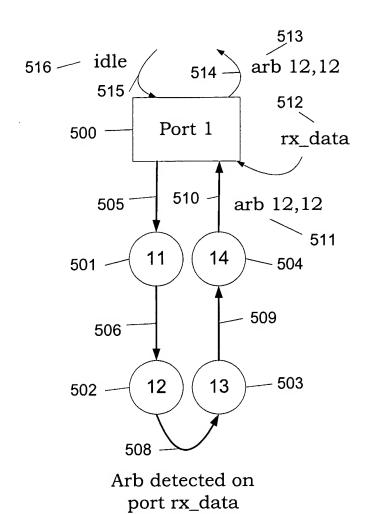


Fig 9a

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527

521

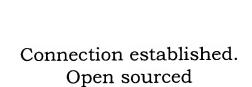
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12

533

528

531 — opn 13, 12



13

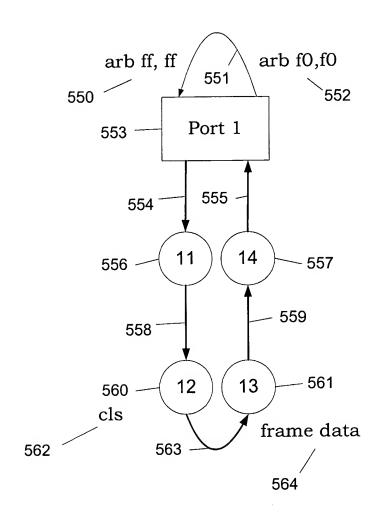
530

532

Fig 9b

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Arbf0 replaced with Arbff. Data Transfered. Close sourced.

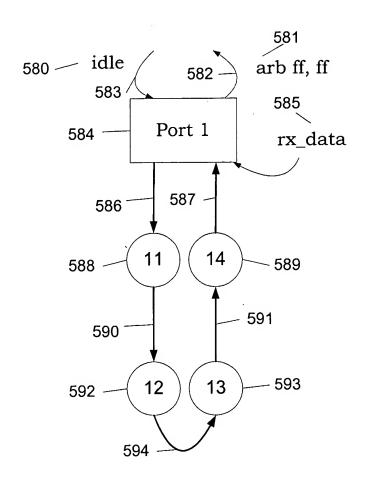
Fig 9c

TITLE: METHODS AND APPARATUS FOR

SWITCHING FIBRE CHANNEL ARBITRATED LOOP SYSTEMS Warren INVENTOR(S): Not yet assigned

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Arbff detected on port rx\_data. Disconnect. Source idles

Fig 9d

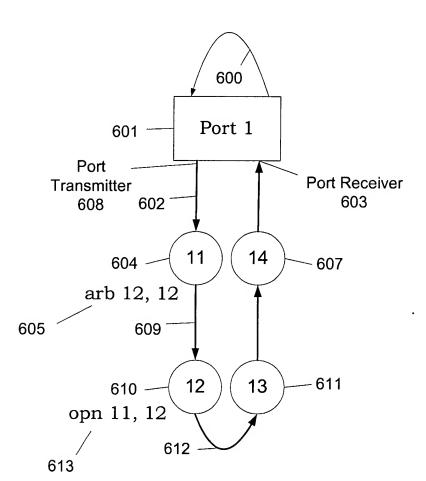
TITLE: METHODS AND APPARATUS FOR

SWITCHING FIBRE CHANNEL ARBITRATED LOOP SYSTEMS Warren INVENTOR(S):

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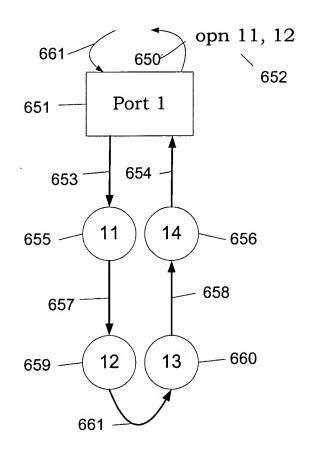
Arbs forwarded. Open sourced.

Fig 10a

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Open detected at port receiver.

Port receiver holds open.

Provides ALPA to router and asserts opn\_connect\_req.

Fig 10b

TITLE: METHODS AND APPARATUS FOR SWITCHING FIBRE CHANNEL ARBITRATED LOOP SYSTEMS INVENTOR(S): Warren U.S. Serial No.: Not yet assigned

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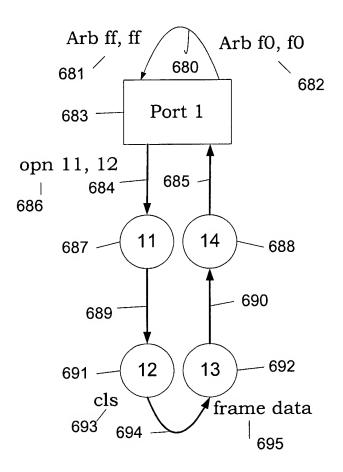


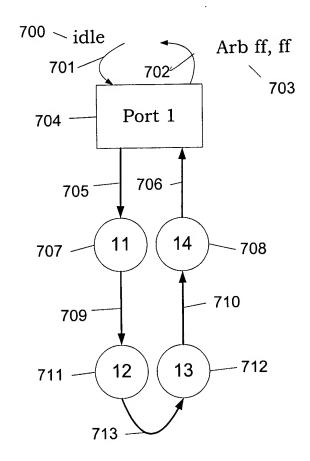
Fig 10c

TITLE: METHODS AND APPARATUS FOR

SWITCHING FIBRE CHANNEL ARBITRATED LOOP SYSTEMS INVENTOR(S): Warren

U.S. Serial No.: Not yet assigned

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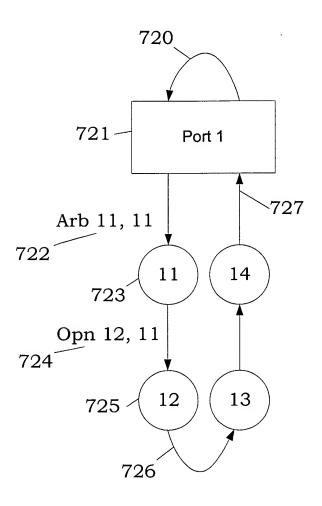
Arbff detected on port rx\_data. Disconnect. Source idles.

Fig 10d

TITLE: METHODS AND APPARATUS FOR

SWITCHING FIBRE CHANNEL
ARBITRATED LOOP SYSTEMS
INVENTOR(S): Warren
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Arbs forwarded. Open Sourced.

Fig 11a

TITLE: METHODS AND APPARATUS FOR SWITCHING FIBRE CHANNEL

ARBITRATED LOOP SYSTEMS INVENTOR(S): Warren

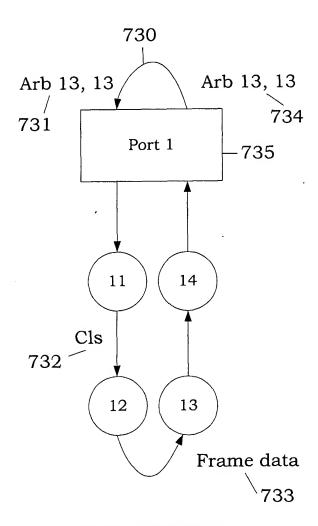
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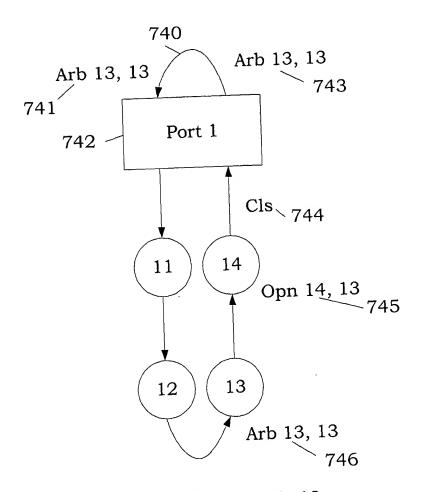
Arb 13 forwarded.
Data Transfered.
Close sourced.

Fig 11b

TITLE: METHODS AND APPARATUS FOR SWITCHING FIBRE CHANNEL

SWITCHING FIBRE CHANNEL
ARBITRATED LOOP SYSTEMS
INVENTOR(S): Warren

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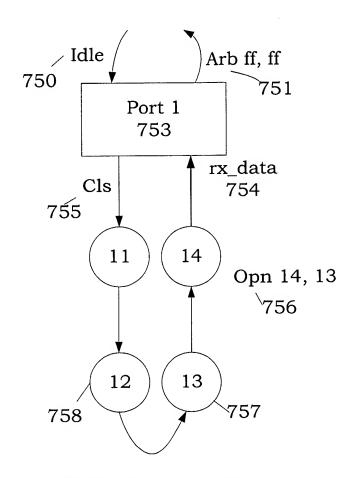


Close forwarded by node 12. Arb 13 received by node 13. Open sourced by node 13.

Fig 11c

TITLE: METHODS AND APPARATUS FOR SWITCHING FIBRE CHANNEL ARBITRATED LOOP SYSTEMS INVENTOR(S): Warren U.S. Serial No.: Not yet assigned

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Close source by node 13.
Forwarded by node 12.
Arb ff Detected on port rx\_data.
Disconnect.
Source idles.

Fig 11d

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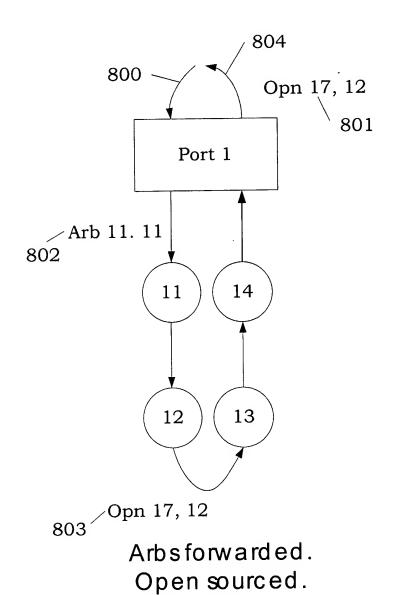
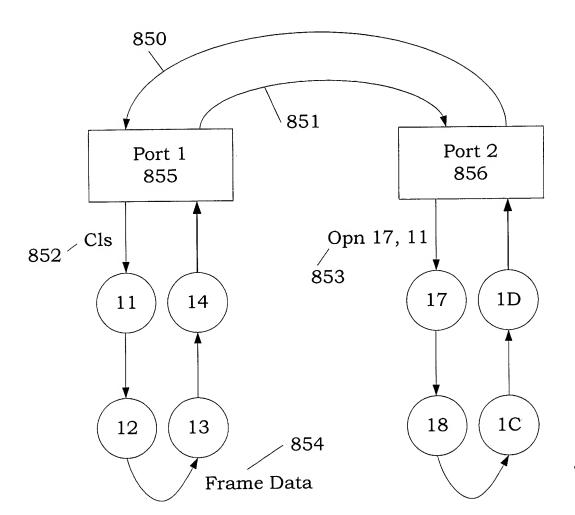


Fig 12a

TITLE: METHODS AND APPARATUS FOR SWITCHING FIBRE CHANNEL ARBITRATED LOOP SYSTEMS INVENTOR(S): Warren U.S. Serial No.: Not yet assigned

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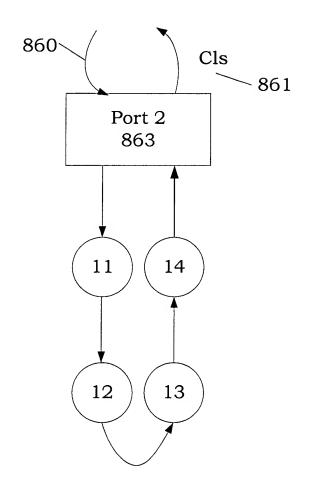
Data transferred. Close sourced.

Open forwarded to Port 2. Open received from Port 1. Data received. Close forwarded.

Fig 12b

U.S. Serial No.: Not yet assigned

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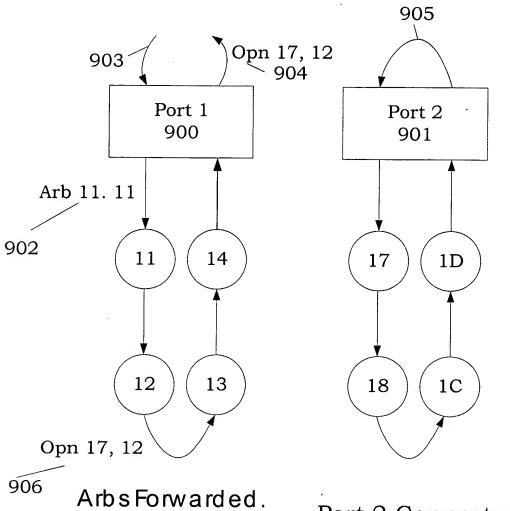


Close detected at transmillter and receiver.
Connection broken.

Fig 12c

TITLE: METHODS AND APPARATUS FOR SWITCHING FIBRE CHANNEL ARBITRATED LOOP SYSTEMS INVENTOR(S): Warren U.S. Serial No.: Not yet assigned

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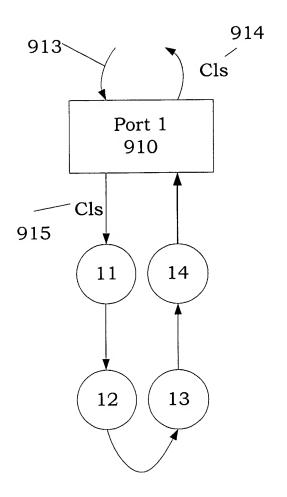


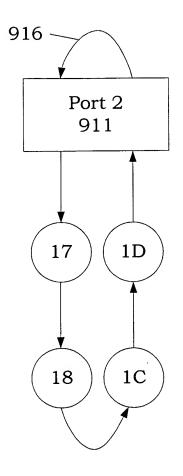
Open Sourced.

Port 2 Connected.

Fig 13a

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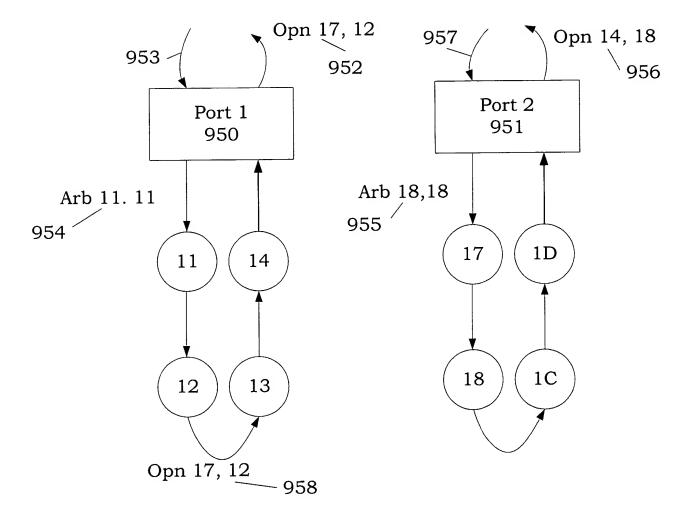


Cls detected at port receiver from node 12.
Cls sourced from port transmitter.

Port 2 still connected.

Fig 13b

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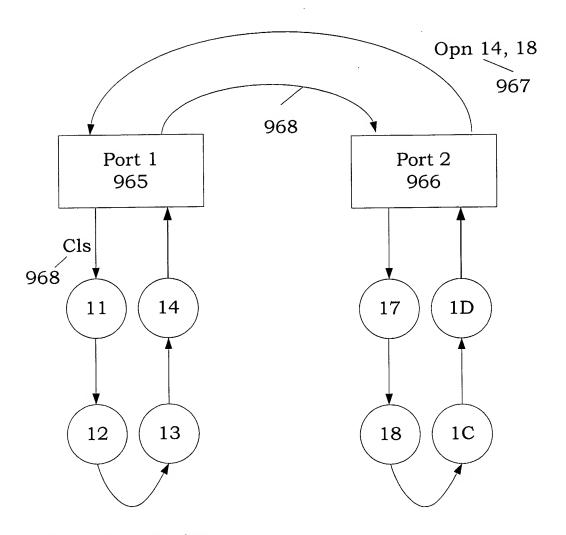


Arbsforwarded. Open sourced.

Arbs forwarded. Open sourced.

Fig 14a

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Port 1 connected as destination port.
Cls sourced from Port 1 transmitter.

Port 2 connected as source Port. Open sourced from Port 2 receiver.

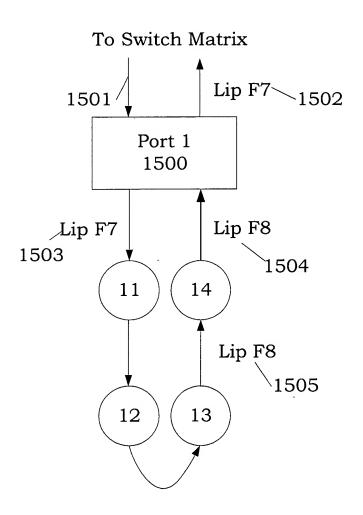
## Fig 14b

INVENTOR(S): U.S. Serial No.:

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Router detects Lip RX'd signal.
Router deasserts switched mode signal.



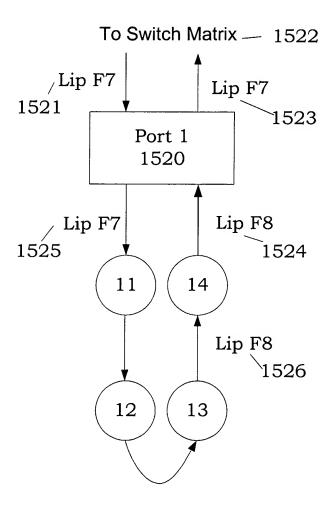
Lip F8 sourced by node 13. Lip F8 replaced by Lip F7 at port receiver. Lip F7 sourced at port transmitter.

Fig 15a

TITLE: METHODS AND APPARATUS FOR SWITCHING FIBRE CHANNEL ARBITRATED LOOP SYSTEMS INVENTOR(S): Warren U.S. Serial No.: Not yet assigned

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Router detects deassertion of port active. Router takes port out of operational loop.



Lip F7 received at port transmitter. Port deasserts port active signal.

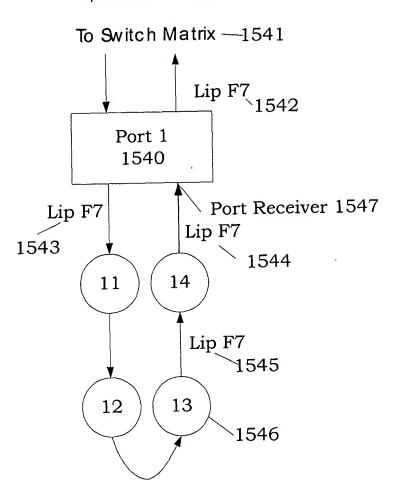
Fig 15b

TITLE: METHODS AND APPARATUS FOR SWITCHING FIBRE CHANNEL ARBITRATED LOOP SYSTEMS INVENTOR(S): Warren U.S. Serial No.: Not yet assigned

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Router detects Lip RX'd signal since port active is now asserted.

Router puts port back into the operaional loop.

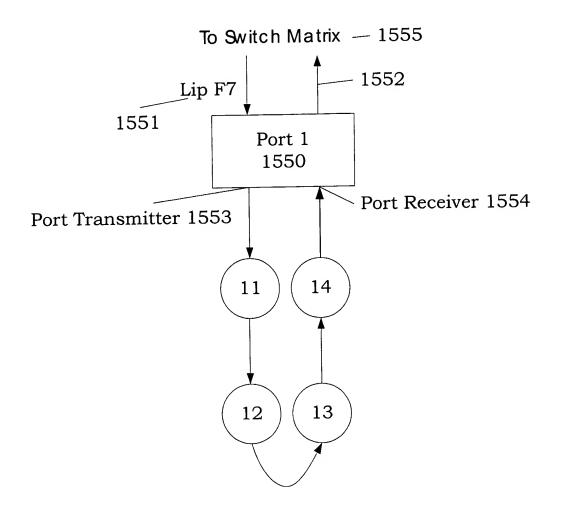


Node 13 "heals", source Lip F7. Lip F7 received at port receiver. Port asserts Port\_Active.

Fig 15c

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## Router continues with loop initialization



Port detects Lip F7 at port transmitter.
Port stops sourcing Lip F7 at port receiver.
Port stops sourcing Lip F7 at port transmitter.

Fig 15d

TITLE: METHODS AND APPARATUS FOR SWITCHING FIBRE CHANNEL

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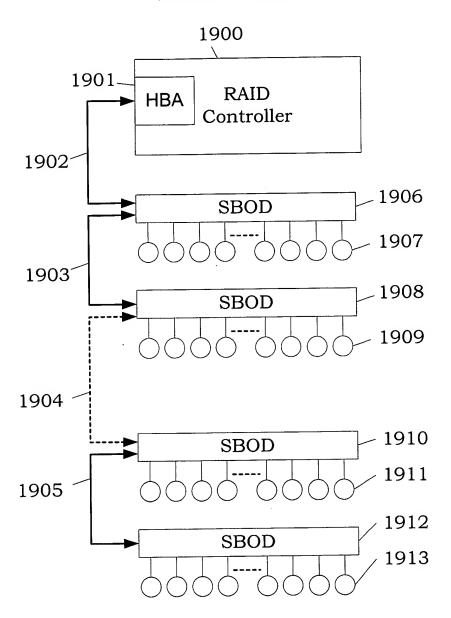


Fig. 16a

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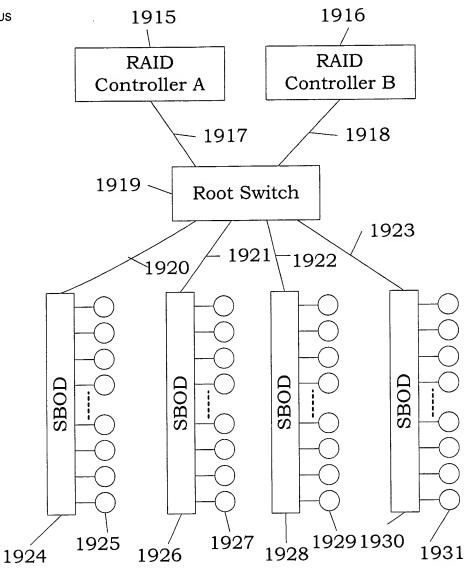


Fig. 16b

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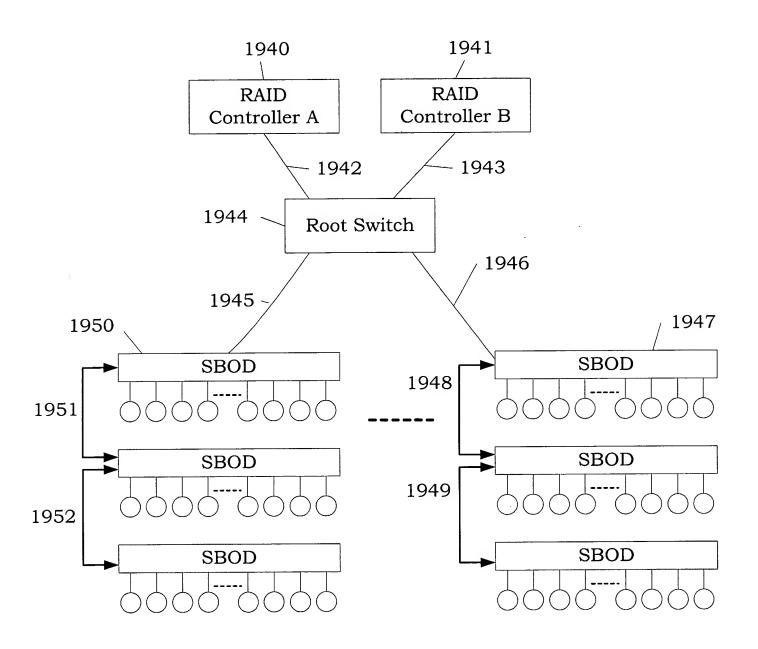


Fig. 16c

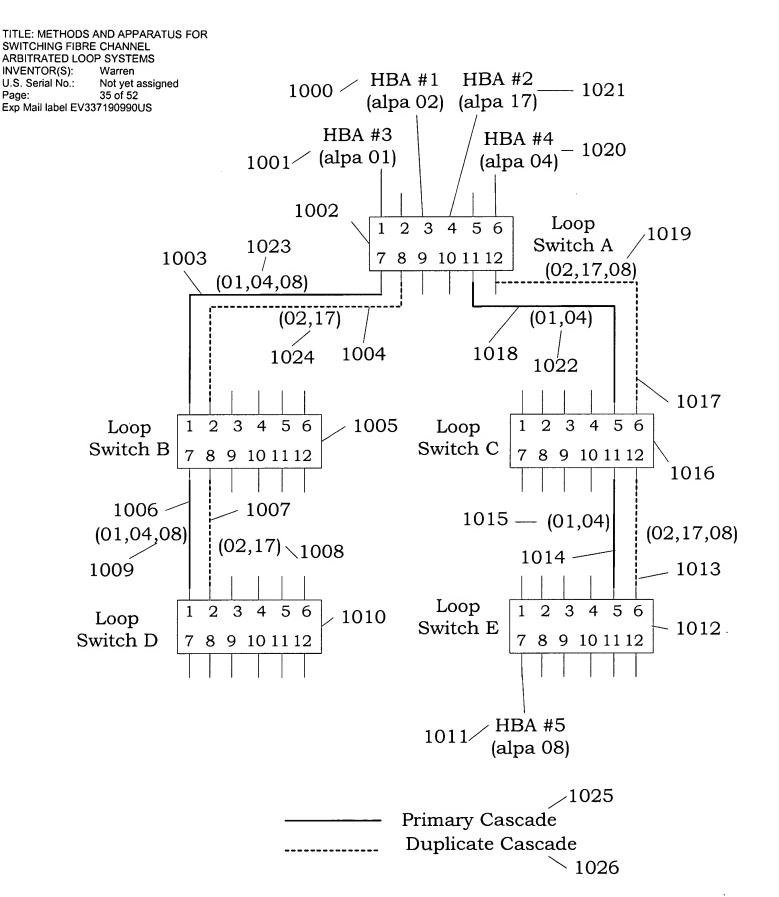


Fig. 17

TITLE: METHODS AND APPARATUS FOR

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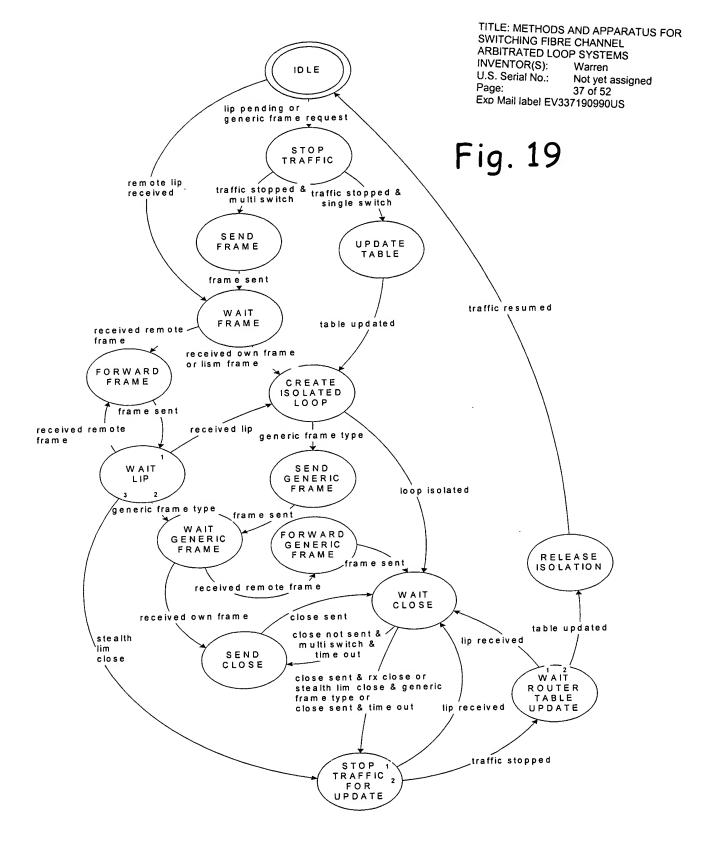
Loop Switch with 1100 Multiple disks on a port \ HBA 3 4 5 6 -1102 1101 7 8 9 10 11 12 Hard Disk 1103 Drive ALPA A3~1105 A9/1106 JBOD AA-1107 AB-1108 AC\_1109

1110

Fig. 18

1111

1104



TITLE: METHODS AND APPARATUS FOR SWITCHING FIBRE CHANNEL ARBITRATED LOOP SYSTEMS INVENTOR(S): Warren U.S. Serial No.: Not yet assigned Page: 38 of 52 Exp Mail label EV337190990US

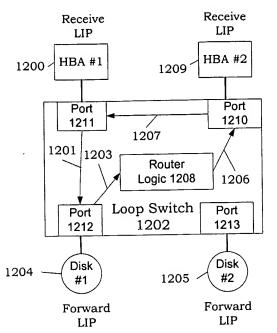


Fig. 20

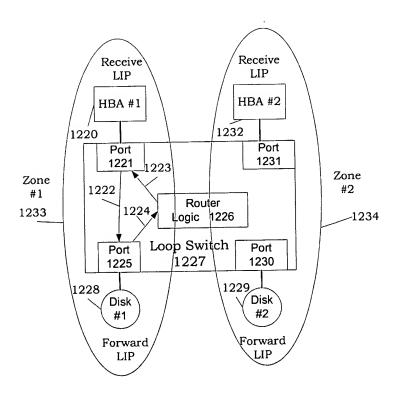


Fig. 21

TITLE: METHODS AND APPARATUS FOR

SWITCHING FIBRE CHANNEL ARBITRATED LOOP SYSTEMS INVENTOR(S): Warren

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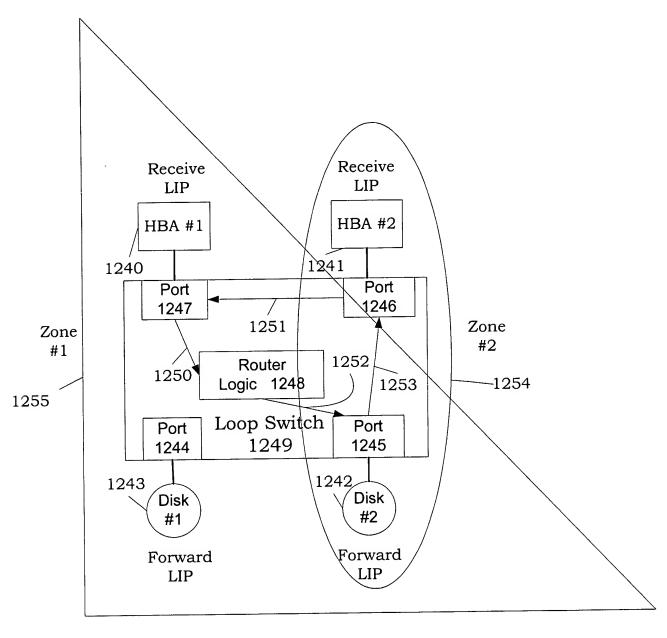


Fig. 22

TITLE: METHODS AND APPARATUS FOR SWITCHING FIBRE CHANNEL ARBITRATED LOOP SYSTEMS INVENTOR(S): Warren Not yet assigned U.S. Serial No.: 40 of 52 Exp Mail label EV337190990US Receive Receive LIP LIP **HBA #2 HBA #1** 1301 1300 Port Port 1309 1308 1327 1326 Router 1324 Logic 1318 1325 Loop Switch SN #1 Port Port 1319 1310 1311 Duplicate Primary 1306 Cascade Cascade 1305 Port Port Loop Switch 1312 1313 SN #2 1320 Zone Zone 1322 #1 #2 Router Logic 1317 1323 1321 1328 1329 Port Port Port 1316 1314 1315 1/304 1302 1303 Disk Disk Disk #2 #3 #1 Forward Forward Forward LIP LIP LIP

Fig. 23

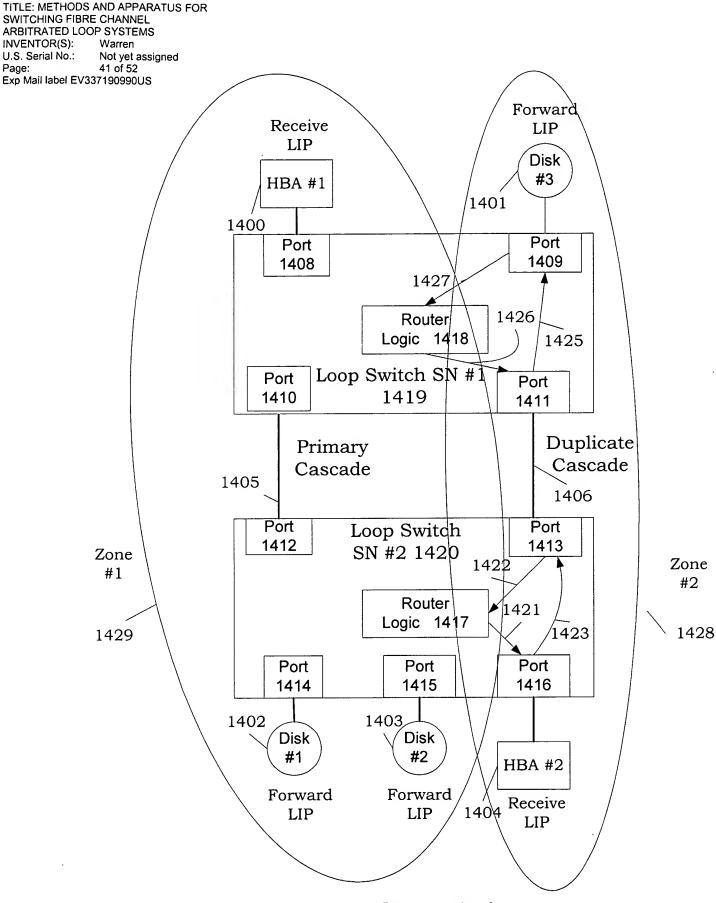


Fig. 24

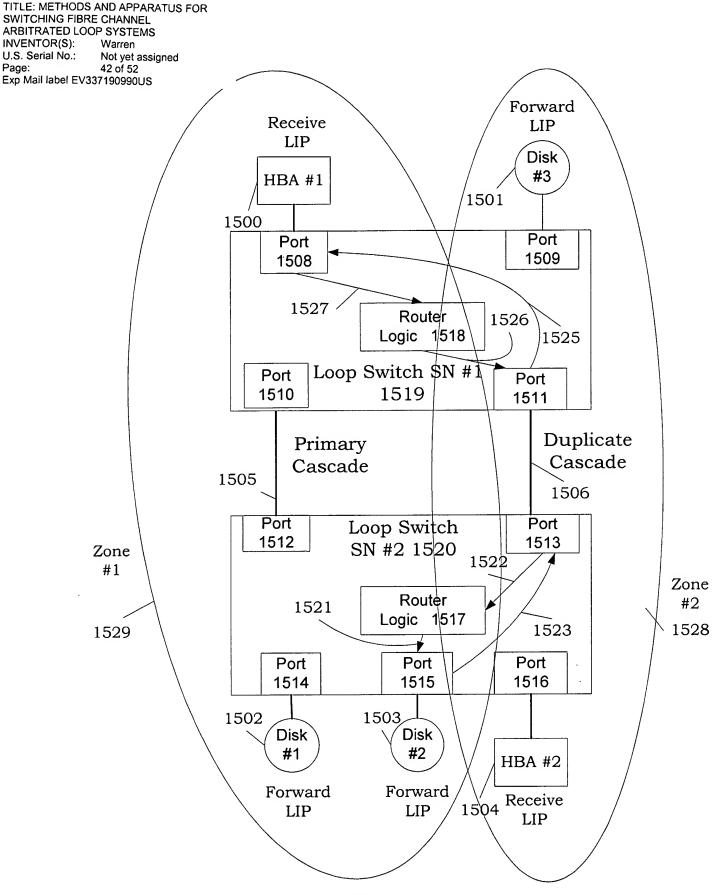


Fig. 25

SWITCHING FIBRE CHANNEL ARBITRATED LOOP SYSTEMS INVENTOR(S): Warren Not yet assigned 43 of 52 U.S. Serial No.: 1600 Exp Mail label EV337190990US Initialize CPU port in Control Register 1601-Frame rx'ed Transmit frame Transmit frame or frame rx'ed 1602 Read interrupt from Write a 32'h0 to Xmt FIFO Pointer register Interrupt Register 1614 1603 Read Rcv FIFO Pointer Move data in to Xmt 1613 Register to find out size FIFO Data Register of frame 1604 1612 Write 32'h0 to Rx FIFO YES Pointer Register Odd number of 16,11 words written Write dummy word of Read data from FIFO 32'h0 to complete 1605 from Rcv FIFO Data NO transfer of data Register Set Send Frame bit in Control Register 1610 1609 1606 YES 1608 Odd number of Rx interrupt that data words read has been sent in Interrupt Register Read dummy word from 1607 Rcv FIFO Register NO

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Page:

Fig. 26

ARBITRATED LOOP SYSTEMS INVENTOR(S): Warren U.S. Serial No.: Not yet assigned 44 of 52 Page: Exp Mail label EV337190990US RAID CONTROLLER 1800 **Initiator HBA2 Initiator HBA1** 1802 1801 Α B A В -1816 -1815 1813 1814 SBOD 1803/ 1817 1818 Disk 1 **SOC422 SOC422** 1820 1807 1806 1819 Disk 16 1834 1829 1830 1833-**SBOD 1804** 1821 1822 Disk 1 **SOC422 SOC422** 1824 1823 1809 1808 Disk 16 1836 1831--1832 -1835 **SBOD 1805** 1825 1826 Disk 1 **SOC422** SOC422 1828 1827 1811 1810 Disk 16 Storage Enclosure 1850

TITLE: METHODS AND APPARATUS FOR

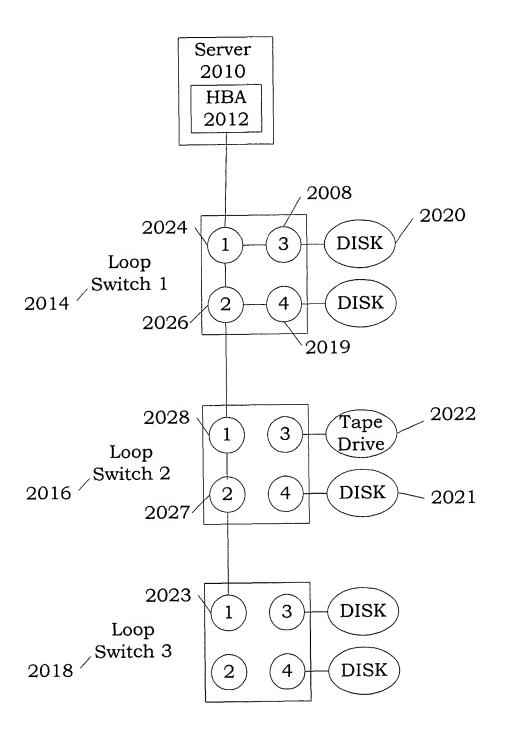
SWITCHING FIBRE CHANNEL

Fig. 27

TITLE: METHODS AND APPARATUS FOR

SWITCHING FIBRE CHANNEL ARBITRATED LOOP SYSTEMS INVENTOR(S): Warren

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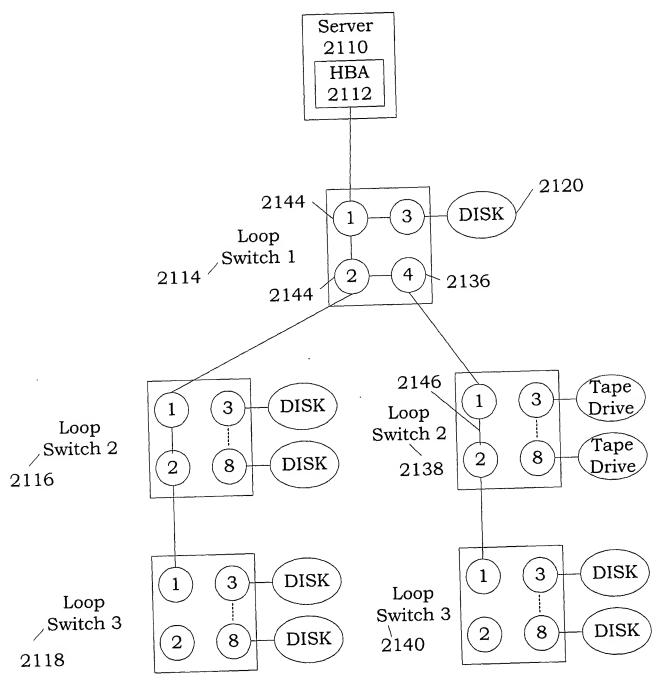


DISK = Fibre Channel Hard Disk Drive

Fig. 28

TITLE: METHODS AND APPARATUS FOR SWITCHING FIBRE CHANNEL ARBITRATED LOOP SYSTEMS INVENTOR(S): Warren U.S. Serial No.: Not yet assigned

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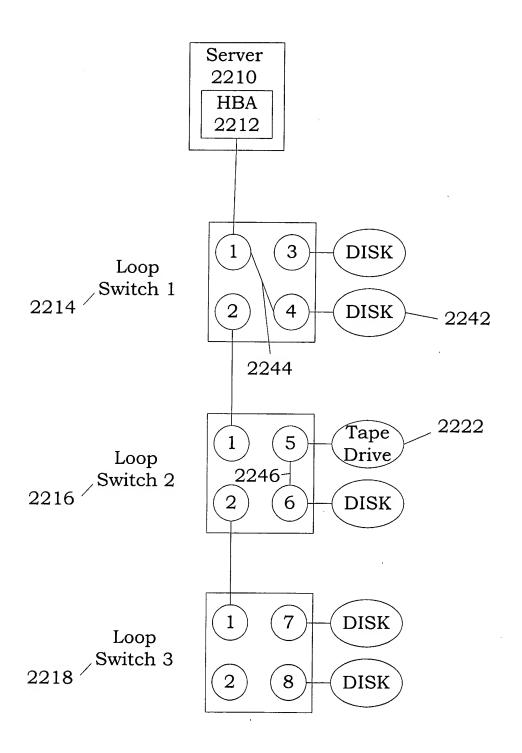
DISK = Fibre Channel Hard Disk Drive

Fig. 29

TITLE: METHODS AND APPARATUS FOR SWITCHING FIBRE CHANNEL ARBITRATED LOOP SYSTEMS INVENTOR(S): Warren U.S. Serial No.: Not yet assigned

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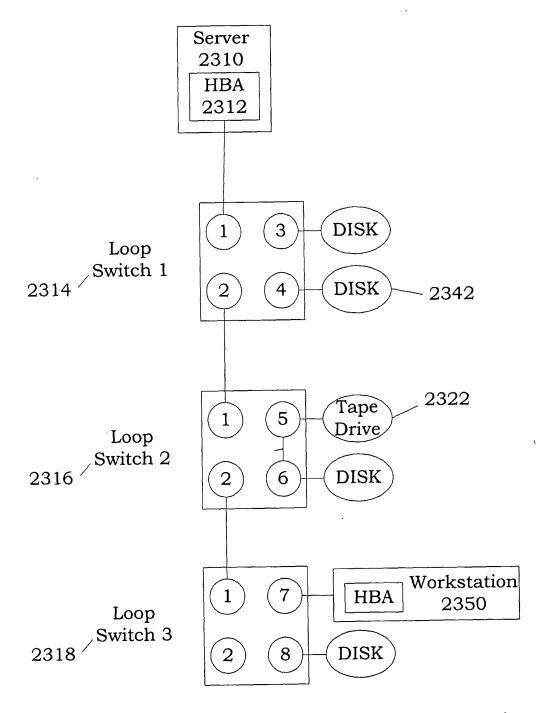
DISK = Fibre Channel Hard Disk Drive

Fig. 30

TITLE: METHODS AND APPARATUS FOR SWITCHING FIBRE CHANNEL ARBITRATED LOOP SYSTEMS INVENTOR(\$): Warren

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DISK = Fibre Channel Hard Disk Drive

Fig. 31

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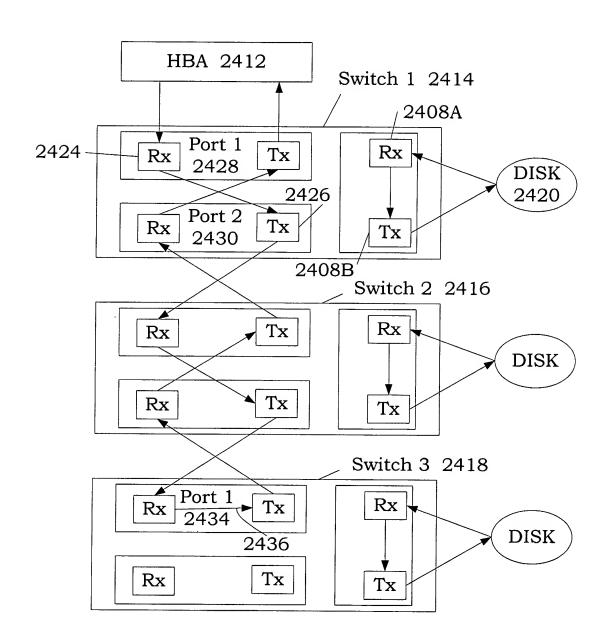


Fig. 32

TITLE: METHODS AND APPARATUS FOR SWITCHING FIBRE CHANNEL ARBITRATED LOOP SYSTEMS INVENTOR(S): Warren

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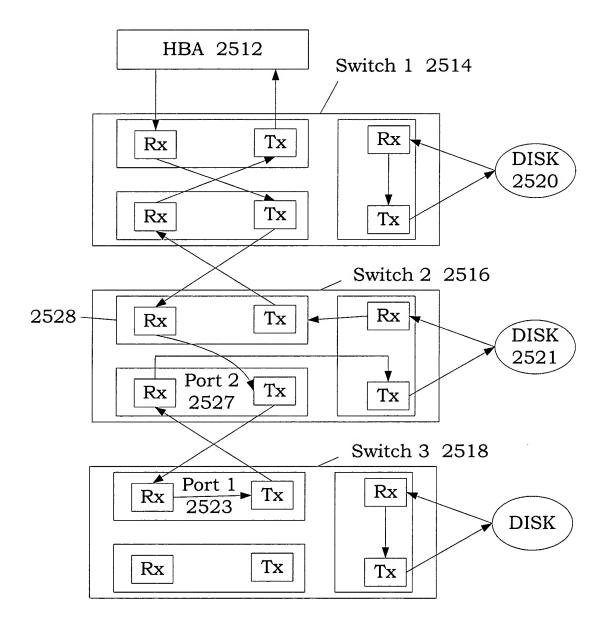


Fig. 33

TITLE: METHODS AND APPARATUS FOR SWITCHING FIBRE CHANNEL ARBITRATED LOOP SYSTEMS INVENTOR(S): Warren

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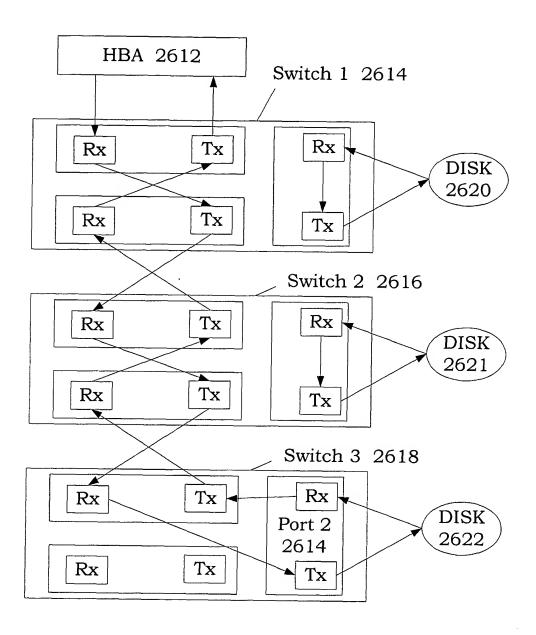


Fig. 34

TITLE: METHODS AND APPARATUS FOR SWITCHING FIBRE CHANNEL ARBITRATED LOOP SYSTEMS INVENTOR(S): Warren U.S. Serial No.: Not yet assigned

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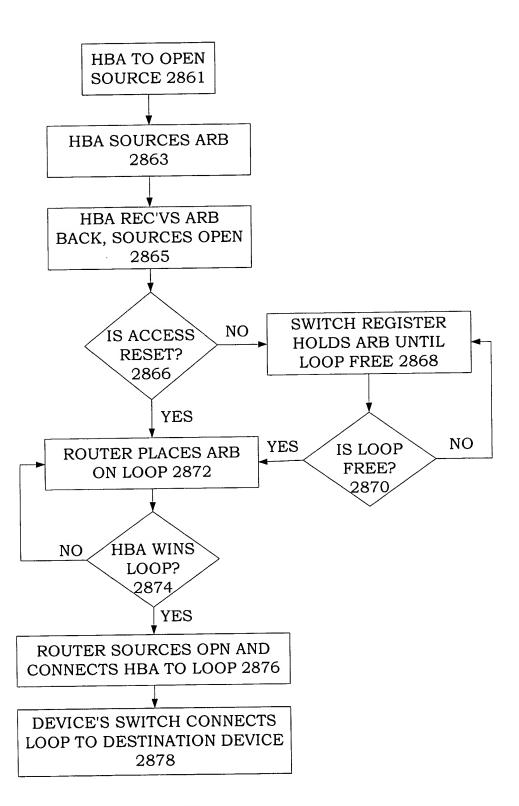


Fig. 35